PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G08C 17/02, 19/16, 23/04 — A1

(11) International Publication Number: WO 96/36953

(43) International Publication Date: 21 November 1996 (21.11.96)

(21) International Application Number: PCT/SG96/00003

(22) International Filing Date: 16 May 1996 (16.05.96)

(30) Priority Data:
95 00457-8 17 May 1995 (17.05.95) SG

(71) Applicant *(for all designated States except US)*: P-SERV TECHNOLOGIES PTE LTD. [SG/SG]; 83 Science Park Drive, #02-02A The Curie, Singapore 118258 (SG).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: NG, Sing, King, Paul [SG/SG]; 306A Lavender Street, Singapore 338813 (SG). TAN, Kok, Wei [SG/SG]; 7A Sing Joo Walk, Singapore 217189 (SG). YIN, Yuen, Chen, Dennis [SG/SG]; Blk 266 #07-226, Bukit Batok East Avenue 4, Singapore 650266 (SG).

(74) Agent: TAN LIM & WONG; Hong Leong Building, 16 Raffles Quay #27-01, Singapore 048581 (SG).

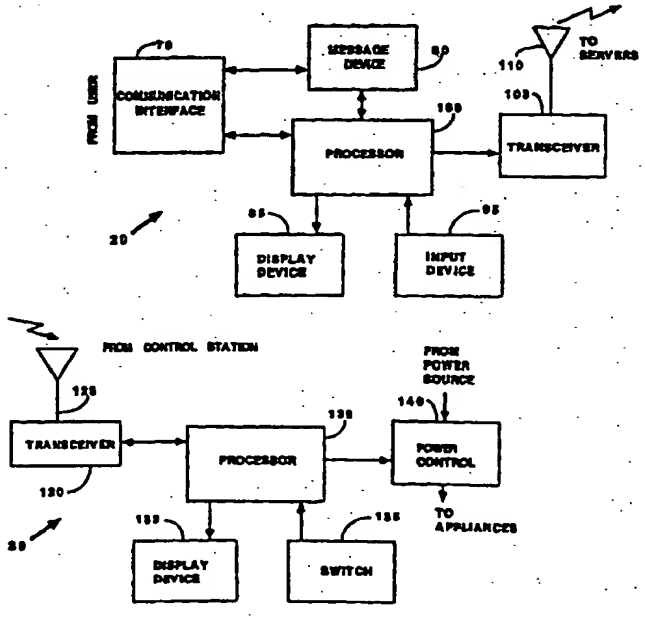
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: WIRELESS AND SECURE CONTROL OF ELECTRICAL EQUIPMENT

(57) Abstract

A wireless automation system is disclosed including apparatus and method for transfering data between a plurality of electrical equipment or appliances (servers). In the preferred embodiment, multiple servers including those having remote infra-red control mainains wireless communication links with at least one control station for data transmission and reception. These servers in turn are either electrically or optically coupled to electrical equipment or appliances. Data frames having unique device identification are encoded using frequency-shift keying technique before they are send to radio frequency transceiver for modulation into FM signals. The control station has a central processor which converts the digital data from the transceiver into square pulses of their respective frequency before transmitting it to the RF transceiver of the servers. It follows that the present invention transmits and receives data frames between a control station and multiple servers securely by using the same radio frequency without affecting the reliability of the system.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgystan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SG	Singapore
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LR	Liberia	SZ	Swaziland
CS	Czechoslovakia	LT	Lithuania	TD	Chad
CZ	Czech Republic	LU	Luxembourg	TG	Togo
DE	Germany	LV	Latvia	TJ	Tajikistan
DK	Denmark	MC	Monaco	TT	Trinidad and Tobago
EE	Estonia	MD	Republic of Moldova	UA	Ukraine
ES	Spain	MG	Madagascar	UG	Uganda
FI	Finland	ML	Mali	US	United States of America
FR	France	MN	Mongolia	UZ	Uzbekistan
GA	Gabon	MR	Mauritania	VN	Viet Nam

WIRELESS AND SECURE CONTROL OF ELECTRICAL EQUIPMENT

FIELD OF THE INVENTION

The present invention relates to electrical appliances. In particular, it pertains to a system for controlling securely and wirelessly electrical equipment.

BACKGROUND OF THE INVENTION

Traditionally electrical equipment and appliances - whether they be in an office or home environment - function as stand-alone devices. The advent of digital technology encourages value-added manufacturers to integrate these previously stand-alone devices such that they work as intelligent systems to make our lives easier and more comfortable. For instance, U.S. Patent No. 5,086,385 discloses an expandable home automation system which incorporates a central processor for controlling multiple and different types of appliances within the home by means of a data bus. It follows that the homeowner can remotely turn on or off a variety of equipment or appliances such as lighting systems and/or security systems which are connected physically to multiple add-on cards on the same data bus as the central processor. Inputs to a computer system such as keyboards, touch screens and/or telephones can control the expandable home automation system.

Although the first generation home automation systems are affordable, connecting the various electrical equipment and appliances to the data bus is cumbersome and time consuming. Having telephone as an input to the home automation system meant that person not authorized to access the system may do so without permission.

U.S. Patent No. 5,022,067 teaches a telephone security system which a long distance carrier access switch to prevent unauthorized access to the telephone input by causing the switch control system to request a telephone identification serial number from the caller. If the serial number is incorrect, the system incorporating U.S. Patent No. 5,022,067 denies access to the system. Moreover, the invention uses a coded query/response dialogue between the telephone and the switch control system for added security.

More recently, X-10, Inc. introduces a wireless home security system consisting of a control console and multiple sensors. The sensors are part of a home security system such as siren, motion detectors and window/door sensors. These sensors send radio frequency signals to the control console which in turn sends digital signals over existing house wiring to activate the siren and flash lights. As the X-10 wireless home security system is an improvement over the hardwired home automation systems because no extra wiring is needed. The user installs the control console by merely plugging it into existing house wiring. Furthermore, operation is simple because the user does not have to assign access codes to the remote sensors nor memorize any complicated codes.

Although home security systems such as the X-10 wireless home security system are hassle-free when it comes to installation, they are not as reliable as the hardwired home automation system.

As will be described, the present invention provides a new automation system for wireless communication and resource sharing among multiple and a variety of electrical equipment and appliances. The present invention

provides an economical, reliable and secure automation system heretofore unknown in the prior art.

OBJECT OF THE INVENTION

It is an object of the present invention to describe a system for controlling multiple and different types of electrical equipment and appliances wirelessly.

It is another object of the present invention to provide a system for controlling multiple and different types of electrical equipment and appliances wireless and securely by using the same radio frequency.

It is a further object of the present invention to provide a system for controlling multiple and different types of electrical equipment and appliances wirelessly and securely in response to receiving instructions over medium such as cable, fiber optics or radio channel and the like.

SUMMARY OF THE INVENTION

A wireless automation system is disclosed including apparatus and methods for transferring data between a plurality of electrical equipment or appliances (servers). In the preferred embodiment, multiple servers including those having remote infra-red control maintains wireless communication links with at least one control station for data transmission and reception. These servers in turn are either electrically or optically coupled to electrical equipment or appliances. Data frames having unique device identification are encoded using frequency-shift keying technique before they are send to radio frequency transceiver for modulation into FM signals. The control station has a central processor which converts the digital data from the transceiver into square pulses of their respective frequency before transmitting it to the RF transceiver of the servers. It follows that the present invention transmits and receives data frames between a control station and multiple servers securely

by using the same radio frequency without effecting the reliability of the system.

With respect to the wireless control of the server having remote infra-red control, the present invention features a learning mode under which the server maps predetermined data formats of the instructions for controlling infra-red control devices in response to detecting either pulse width modulation or pulse distance modulation signals and compresses the same.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the overall architecture of the present invention where a control station controls via radio frequency a plurality of servers.

FIG. 2 is a schematic diagram of the control station of the present invention.

FIG. 3 is a schematic diagram of the AC server of the present invention.

FIG. 4 is a schematic diagram of the Infra-red (IR) server of the present invention.

FIG. 5 is a schematic diagram of the Wall Mount (WM) server of the present invention.

FIG. 6A is a logical structure of the data format transmitted by the control station of the present invention.

FIG. 6B shows a timing diagram of the encoding scheme employed in the preferred embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENT OF THE INVENTION

A system for wireless and secure control of electrical equipment and appliances is disclosed. In the following description for purposes of explanation, specific numbers, bytes, registers, addresses, times, signals, and data formats, etc. are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced without these specific details. In other instances, well known circuits and devices are shown in block diagram form in order not to obscure the present invention unnecessarily.

FIG. 1 illustrates a wireless control system 10 adapted to utilize the teachings of the present invention. The present invention includes at least one control station 20 and at least one server. In the preferred embodiment of the present invention, the control station 20 maintains communication links with a plurality of control subsystems identified by the numerals 30 through 60 respectively. For the purposes of this Specification, all control subsystems which maintain communications links with the control station 20 are collectively referred to as "servers". The details of how each of the servers interfaces with the control station and vice versa shall be elaborated further below. Not shown in FIG. 1 but should be understood by one skilled in the art, the control station 20 is linked externally by either a cable such that users of the wireless control system 10 may access the system remotely. The cable may comprise any shared media, such as coaxial cable, fiber optics, radio channel, telephone line and the like. Similarly, electrical equipment and/or appliances which are coupled to servers are not shown explicitly in order not to obscure the presentation of the present invention. It should be understood by one skilled in the art that the server 30 is coupled to the power source which provide power to the electrical equipment and/or appliances of system 10. By the

same token, server 40 is optically coupled but not shown graphically to equipment and appliances which come with remote infra-red (IR) controllers. Last but not least, the servers 50 - 60 is connected to lighting equipment or similar fixtures for controlling the level of brightness of such apparatus. As the servers 50 - 60 are usually wall mounted (WM) but not necessarily so, they are identified as WM servers.

As will be described, the present invention provides a system for controlling at least one control station 20 and a plurality of servers 30 - 60 wirelessly and securely, utilizing a new data format for the same radio frequency. The present invention's architecture and protocol minimizes interference of control stations even if they are in close proximity to each other. In an age where radio frequency is becoming a scarce resource, the present invention provide an economical and simple method for controlling electrical equipment and appliances intelligently without comprising the need for data security. In the current embodiment, the present invention operates 50 - 100 MHz at 100 Milliwatts output and complies with Telecommunications Authority of Singapore (TAS) Specification 12.

FIG. 2 is a schematic diagram of the control station 20 of the present invention. The control station 20 comprises a communication interface 70, a messaging device 80, a display device 85, and input device 95, a central processor 100, a transceiver 105 and an antenna 110. The communication interface 70 comprises circuitry, logic and software, known in the art for sensing cable (not shown) and receiving signals from users as well as sending signals to users. For purposes of clarity, the specific circuits, programming routines, and other logic comprising communication interface 70 will not be disclosed in the Specifications, as means for accomplishing its function as defined in this

patent are known in the art. As mentioned above, the cable coupled to the communication interface 70 may comprise any shared media, such as coaxial cable, fiber optics, radio channel, telephone line and the like.

Referring again to FIG. 2, the communication interface 70 is coupled to the message device 80 for transmitting thereto signals from the cable. In the preferred embodiment of the present invention, the message device 80 is a telephone answering machine which among other functions stores incoming messages with time stamp, plays pre-programmed synthesized message, and decodes the DTMF signal from the user's telephone set. The output of the message device 80 is but one of two sources of input to the processor 100: the other is the input device 95. The processor 100 controls the overall operation of the control system 10. The processor 100 generates commands which are sent to the servers 30 - 60, configures the servers by giving each one of them a unique identity codes and name, and to test the integrity of the communication links between the control station 20 and the servers 30 - 60. The output of the processor 100 is coupled to the input of the transceiver 105 for transmitting instruction and data to the servers 30 - 60 (not shown) over the antenna 110. In the preferred embodiment of the present invention, the processor 100 is a microcontroller TMP87CC20 from Toshiba Corporation.

FIG. 3 is a schematic diagram of the AC server of the present invention. The server 30 comprises a transceiver 120, an antenna 125, a processor 130, a display device 133, a switch 135, and a power control 140. The transceiver 120 receives RF signals from the transceiver 105 of the control station 20 over the antenna 125 and converts them to digital signals. The output of the transceiver 120 is provided as input to the processor 130 for turning on or off the power source (not shown in FIG. 3). The display device provides the user

with useful information about the status of the server 30 such as power on, communication link testing mode and others. The switch 135 is coupled to the processor 130 for permitting the user to turn on or off the appliance manually. The output of the processor 130 is provided as input to the power control 140 for controlling the supply of power to electrical equipment and/or appliances in the system 10. In the preferred embodiment of the present invention, the processor 130 is a microcontroller TMP47C202 from Toshiba Corporation.

FIG. 4 is a schematic diagram of the Infra-red (IR) server of the present invention. The server 40 comprises a transceiver 150, an antenna 155, a processor 160, a display device 163, an input device 165, a infra-red (IR) sensor 170 and a IR transmitter 180. The transceiver 150 receives RF signals from the transceiver 105 of the control station 20 over the antenna 155 and converts them to digital signals. The output of the transceiver 150 is provided as input to the processor 160 for regenerating IR signals when instructed by the control station 20. The display device indicates to the user when the operation status of server 40 such as, learning mode, transmission mode, etc. As will be described further below, the processor 160 learns, processes, compresses and stores the IR signals from the IR sensor 170. The Input device 165 is coupled to the processor 160 for receiving from IR sensors IR signals, and recording pre-defined programmable function keys which correspond with the IR signals from the remote IR controller. The output of the processor 160 is provided as input to the IR transmitter 180 for activating and deactivating electrical equipment and/or appliances in the system 10. Although not shown physically in FIG. 4, there is a toggle for permitting the user to use the IR server reomtely. In the preferred embodiment of the present invention, the processor 160 is a microcontroller TMP47C422 from Toshiba Corporation.

FIG. 5 is a schematic diagram of the Wall Mount (WM) server of the present invention. The server 50 comprises a transceiver 190, an antenna 195, a processor 200, a display LED 203, an input device 205, and a power control 210. The transceiver 190 receives RF signals from the transceiver 105 of the control station 20 over the antenna 125 and converts them to digital signals. The output of the transceiver 190 is provided as input to the processor 200 for turning on or off the power source (not shown in FIG. 5). The display device provides the user with useful information about the status of the server 50 such as power on, communication link testing mode and others. The input device 205 is coupled to the processor 200 for permitting the user to turn on or off the appliance manually. The output of the processor 200 is provided as input to the power control 210 for controlling the level of power or brightness to electrical equipment and/or appliances in the system 10.

FIG. 6A is a logical structure of the data package transmitted by the control station of the present invention. The structure of the data packge is one of the novelty features of the present invention as it permits the secure and wireless transmission of instruction and data to control electrical equipment and/or appliances without using different radio frequency. More importantly, the structure and contents of the data package minimizes false activation of wireless control system. As such, the integrity of such systems is enchanced. Referring to FIG. 6A, the present invention utilizes a basic unit of data transmission known as a "package" 220. Package 220 includes a preamble 230, a SYN 240, a Server ID 250, an opcode 260, an operand 270 and a checksum 280. The functions and purposes of each of these fields as they relate to the communication between the control station 20 and the servers 30 - 60 are summarized as follows:

Preamble	Wakes up the Servers
SYN	Indicates the start of Data
Server ID	Identifies the Sender and Receiver
Opcode	Instructs Server what to do
Operand	Provides all parameters to execute instructions in control field
Checksum	Detects error under CRC16 checksum

Referring again to FIG. 6A, each transmission between the control station 20 and any of the servers 30 - 60 starts with the preamble 230 of each data package 220. The preamble 230 allows the servers 30 - 60 to synchronize with the control station 20. At the same time, the preamble 230 informs the servers that data is arriving. In the preferred embodiment of the present invention, the preamble comprises 24 frames of 9-bit data each. The first eight most significant bits is the exclusive OR product of Device ID with the 8 least significant bits of the Master ID. The Server ID field specifies Master ID and Device ID. The least significant bit of the preamble is the preamble gap. It consists of two square pulses of frequency 625 Hz. The purpose of the preamble gap is to provide word synchronization. The servers reads in data after they detect such as frequency consecutively. The preamble 230 conserves the servers' energy since the latter wakes up only when required. It follows that if the appropriate preamble is not received, the servers can be placed in a sleep mode.

The SYN field 240 indicates the start of the data stream. It comprises 8 bits. For actual data with the same pattern as the SYN field, it will be stuffed with another bit of Logic 1 by bit stuffing means known in the art.

The Server ID field specifies Master ID and Device ID, which collectively are known as Server ID. The Server ID comprises 32 bits: the first 24 bits is the

Master ID and the next 5 bits the Device ID. The Master ID identifies the Master which sends the data. Each Master is given an unique Master ID during factory production. The Master Unit uses the Device ID to inform the Servers who is the receipient of data from it. The user configures each server with a device ID. It should be understood that servers can have the same Device ID, which means that servers with such ID will be activated with the same instructions.

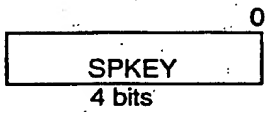
Again in FIG. 6A, Opcode 260 specifies the following operation code:

OPCODE	OPERATION	DESCRIPTION
$0	Test	To test the communication link of the Slave Unit
$1	Configure Server	To configure Server
$2	OFF Instruction	To turn OFF Device
$3	ON Instruction	To turn ON Device

The Opcode 260 comprises 5 bits - 4 bits for the operation bits and 1 bit for TYPE. TYPE specifies whether this data is for execution or checking. A value of zero indicates that this data is being sent for the first time and is to be executed immediately. A value of one indicates that data previously sent and is for checking only. However, if the Server did not receive the previous data, the instruction is executed.

The Operand field 270 in FIG. 6A contains the necessary information for the Server to operate as desired. The contents of the Operand field 270 varies with the type of Opcode and Server. Referring to the previous table above, the Operand field is omitted if Opcode is either zero or one. In other words, should the operation calls for the Master Unit to test the communication link with the Slave Unit, or the Master Unit to configure the Server, the Operand

field shall have no value. Again in the Opcode table above, only IR server 40 receives the following operand when the Opcode is 2 - i.e., OFF instruction:



The Operand field 270 also varies when the Opcode is to turn ON Device. The contents of the Operand field depends on the target Server. For AC Server 30, this field consists of Duration only. For IR Server, the Operand field comprises the Duration, and five keys and the OFF key. Each key is a 4-bit field with which the user can activate the IR Server. In the preferred embodiment of the present invention, a maximum of five keys are given. Finally, for WM Server, the Brightness Level is included in this field in addition to the Duration. Duration is a subfield which specifies the duration to execute the ON command. If Duration lapses, the device will be turned OFF.

Checksum field 280 is 16 bit wide and contains the results of cyclic redundancy check CRC-16, where CRC-16 = $X^{16} + X^{15} + X^2 + 1$. The bit patter is 1 1000 000 000 0101.

The data package 220 in FIG. 6A is encoded and transmitted over radio frequency using a technique known as Frequency-Shift Keying (FSK). All digital data will be encoded into their respective pre-defined frequency before sending them to the transceiver for modulation into FM signals. The digital data are converted into square pulses of their respective frequency by the processor 100 of the Master Unit before sending them to the RF transceiver. The Servers receive the FSK square pulses from the RF transceiver and decode into their respective logic data.

FIG. 6B shows a timing diagram of the encoding scheme employed in the preferred embodiment of the present invention where the logic High and Low of the FSK scheme is shown. Besides the High and Low, there is another frequency to represent the Preamble Gap which was mentioned in connection with the Preamble 230 of the data package 220. The three frequencies adopted 3.125Khz, to represent Logic High, 1.25KHz, for Logic Low, and the last frequency 625Hz, for identifying the Preamble Gap. The transmission baud rate is 312.5bps.

In FIGS. 1 and 4 the IR Server 40 controls electrical equipment or appliance with infra-red (IR) remote controls. Users normally activate appliance with IR remote controls with a remote IR controller. Each buttom on the IR remote controller corresponds to different command. When such a button is pressed, the command corresponding to that button is generated as infra-red signals is transmitted to a sensor on the appliance. The IR sensor 40 has a plurality of programmable keys and a infra-red sensor. By pressing a key until the LED lights up, the IR Server is put into a learning mode. The user should point the original remote IR remote controller at the IR sensor 170 of the IR Server 40 in FIG. 4. When a button of the remote IR controller is pressed, the IR Server 40 learns the command associated with that button. The IR signals is analyzed, compressed and stored by the IR Server 40. In the preferred embodiment of the present invention, a typical IR Server for controlling a Videocassette Recorder (VCR) has the following keys corresponding to commands:

KEY on IR Server	COMMANDS STORED
1	REWIND
2	STOP

3	CHANNEL 3
4	CHANNEL 10
5	CHANNEL 5
6	CHANNEL 12
7	TV 3
8	CHANNEL 8
9	PLAY
0	RECORD
ON	TURN ON VCR
OFF	TURN OFF VCR

For instance, the user wishes to record a television program on Channel 12. The Control Station 20 sends commands to the IR Server to execute keys "ON", "6" and "0". The commands are sent through radio frequency. When the IR Server 40 receives the commands from the Control Station 20, the IR Server regenerates and transmit the corresponding IR signals which it had earlier compressed and stored in the memory of IR Server. In the embodiment of the present invention, the memory is a EEPROM.

In the learning mode of the IR Server 40, the IR Server responds to two basic infra-red signals protocols: (1) Pulse Distance Modulation (PDM) and (2) Pulse Width Modulation (PWD). In PDM, a carrier is transmitted at constant periods within the data frames while the period between the transmission of adjacent pulses are modulated. In PWM, the period between carrier transmission remain constant while the period wherein the carrier is actually transmitted is modulated. When the IR Server 40 detects either protocol, the system 10 sets a flag for controlling the appropriate compression scheme to use.

The same compression scheme is used for PDM and PWM because the formats are consistent in how data are presented to a device. The difference lies in the location of the significant bits. Depending on which of the two protocols is used, the significant bit is found on either the even or odd bits on the nibbles of data stored in the allocated working RAM space. The compression ratio is 2:1. Thereafter, compressed data is stored in the EEPROM.

While the present invention has been described particularly with reference to FIGS. **1** to **6** with emphasis on a system controlling securely and wirelessly electrical equipment, it should be understood that the figures are for illustration only and should not be taken a limitation on the invention. In addition, it is clear that the method and apparatus of the present invention has utility in many applications where wireless control of equipment is required. It is contemplated that many changes and modifications may be made by one of ordinary skill in the art without departing from the spirit and the scope of the invention as described.

CLAIMS

1. A system for controlling at least one electrical equipment wirelessly and securely, said system comprising:

a control station having at least a first communication link with a remote user for receiving instructions therefrom, said control station transmitting data in response to receiving instructions from said remote user; and

at least one server having a second communication link with said control station for receiving data therefrom, said server being coupled to said electrical equipment over a third communication link for activating or deactivating said electrical equipment,

whereby said user controls said server wirelessly and securely without compromising the security of said system.

2. The system according to claim 1 wherein said first communication link is telephonic.

3. The system according to claim 1 wherein said first communication link is celluar.

4. The system according to claim 1 wherein said control station comprises at least a microprocessor and at least one transmitter.

5. The system according to claim 1 wherein said data comprise a format for identifying said control station, said server, and said equipment uniquely.

6. The system according to claim 5 wherein said format further comprises contiguous fields for controlling said server without using more than one frequency.

7. The system according to claim 5 wherein said format further comprises contiguous fields for verifying the integrity of said second communication link.

8. The system according to claim 1 wherein said second communication link is wireless.

9. The system according to claim 7 wherein said second communication link comprises radio frequency.

10. The system according to claim 1 wherein said server comprising at least one receiver, and at least one microprocessor.

11. The system according to claim 1 wherein said third communication link is infra-red.

12. The system according to claim 1 wherein said third communication link is hard-wired.

13. A system for controlling at least one electrical equipment wirelessly and securely, said system comprising:

a control station having at least a first communication link with a remote user for receiving instructions therefrom, said control station generating data in response to receiving instructions from said remote user, said control station further comprising at least one microprocessor, at least one receiver for receiving said data, and at least one transmitter for transmitting said data; and

at least one server having a second communication link with said control station for receiving data therefrom, said server further comprising at least one receiver and at least one microprocessor for mapping said data from said control station into signals recognizable by said electrical equipment, said server being coupled to said electrical equipment over a third communication link for activating or deactivating said electrical equipment,

whereby said user controls said server wirelessly and securely without compromising the security of said system.

14. The system according to claim 13 wherein said first communication link is telephonic.

15. The system according to claim 13 wherein said first communication link is celluar.

16. The system according to claim 13 wherein said data comprise a format for identifying said control station, said server, and said equipment uniquely.

17. The system according to claim 16 wherein said format further comprises contiguous fields for controlling said server and minimizing false activation and deactivation of said system.

18. The system according to claim 16 wherein said format further comprises contiguous fields for verifying the integrity of said second communication link.

19. The system according to claim 13 wherein said second communication link is wireless.

20. The system according to claim 13 wherein said second communication link comprises radio frequency.

21 The system according to claim 13 wherein said third communication link is infra-red.

22. The system according to claim 13 wherein said third communication link is hard-wired.

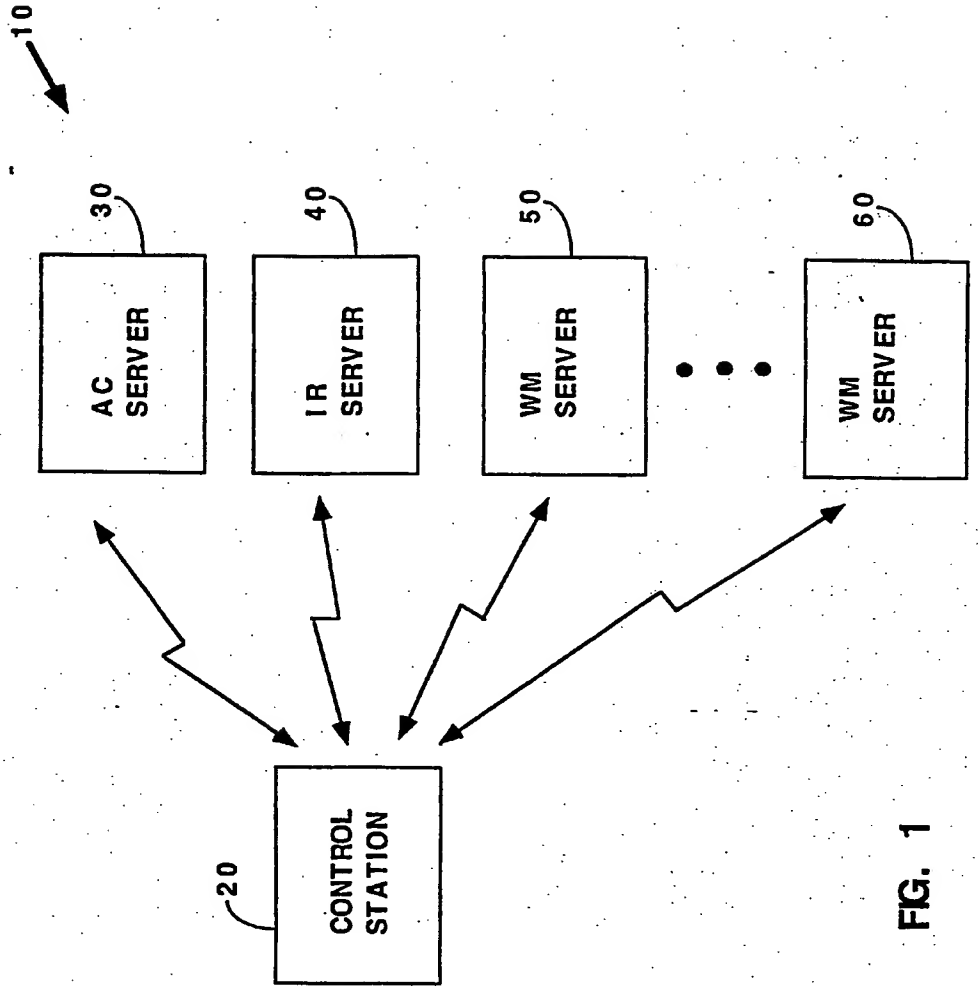

10
30
AC SERVER
40
IR SERVER
50
WM SERVER
60
WM SERVER
20
CONTROL STATION

FIG. 1

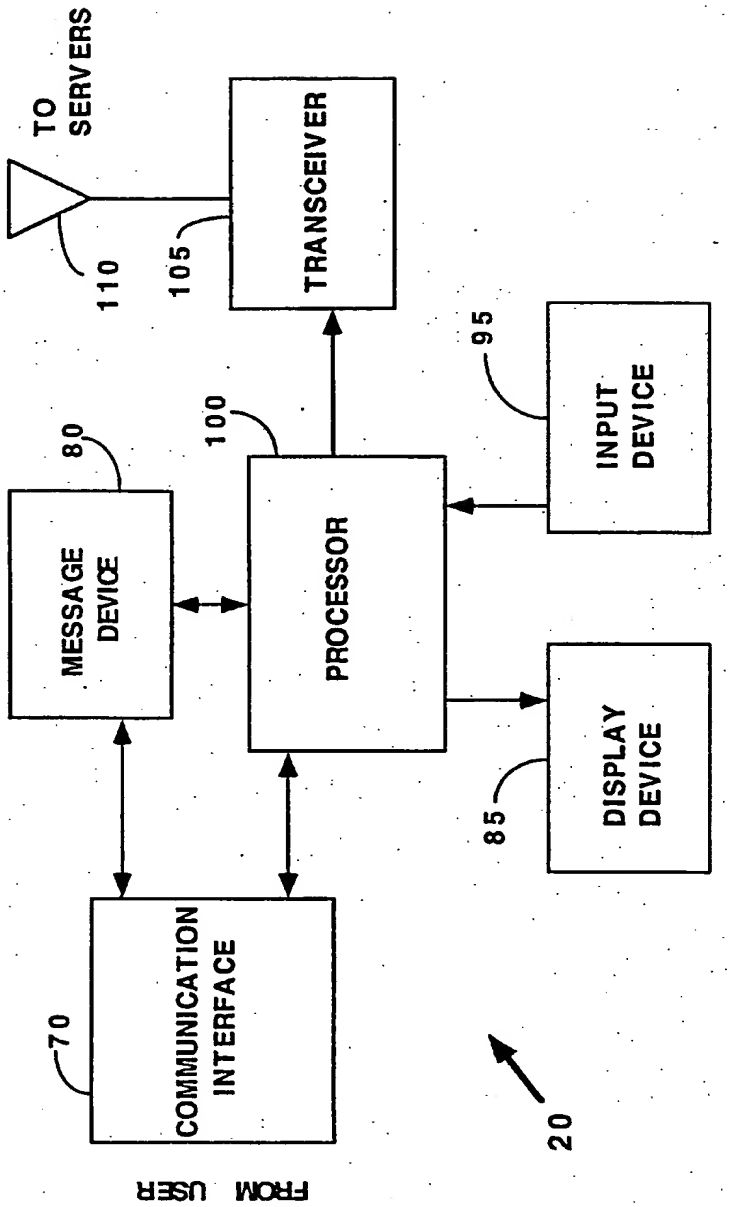

TO SERVERS
110
105
TRANSCEIVER
95
INPUT DEVICE
100
80
MESSAGE DEVICE
PROCESSOR
85
DISPLAY DEVICE
70
COMMUNICATION INTERFACE
20
FROM USER

FIG. 2

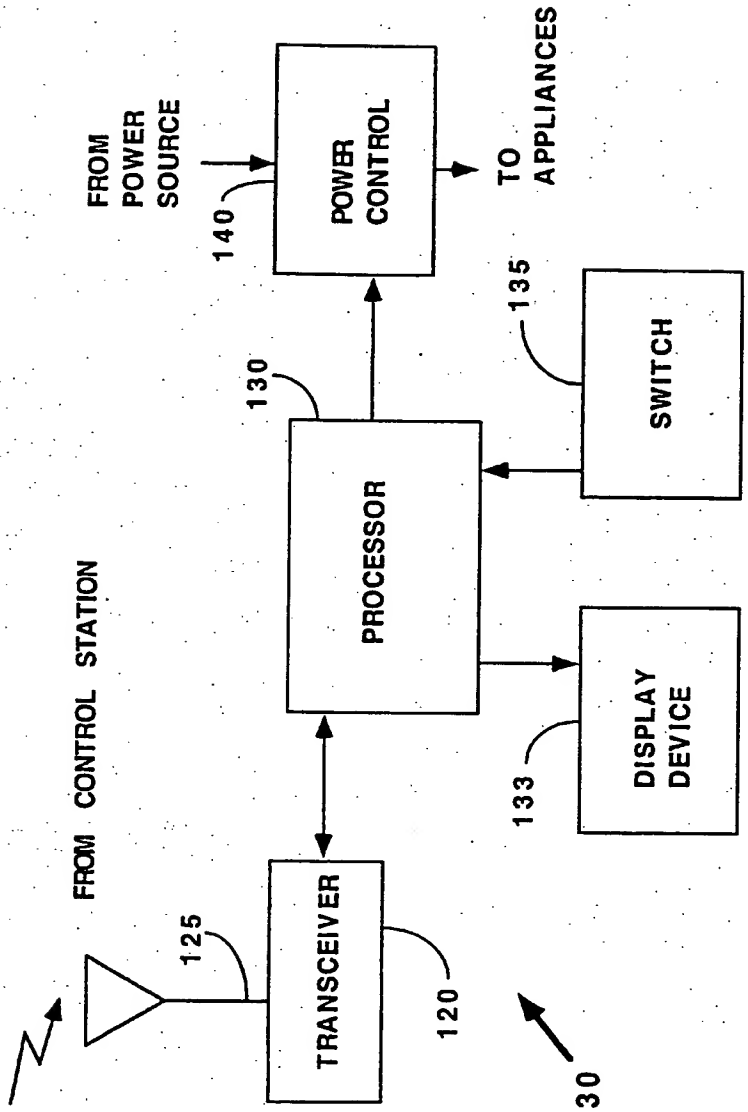

FROM CONTROL STATION
125
TRANSCEIVER
120
30
PROCESSOR
130
FROM POWER SOURCE
140
POWER CONTROL
TO APPLIANCES
135
SWITCH
133
DISPLAY DEVICE

FIG. 3

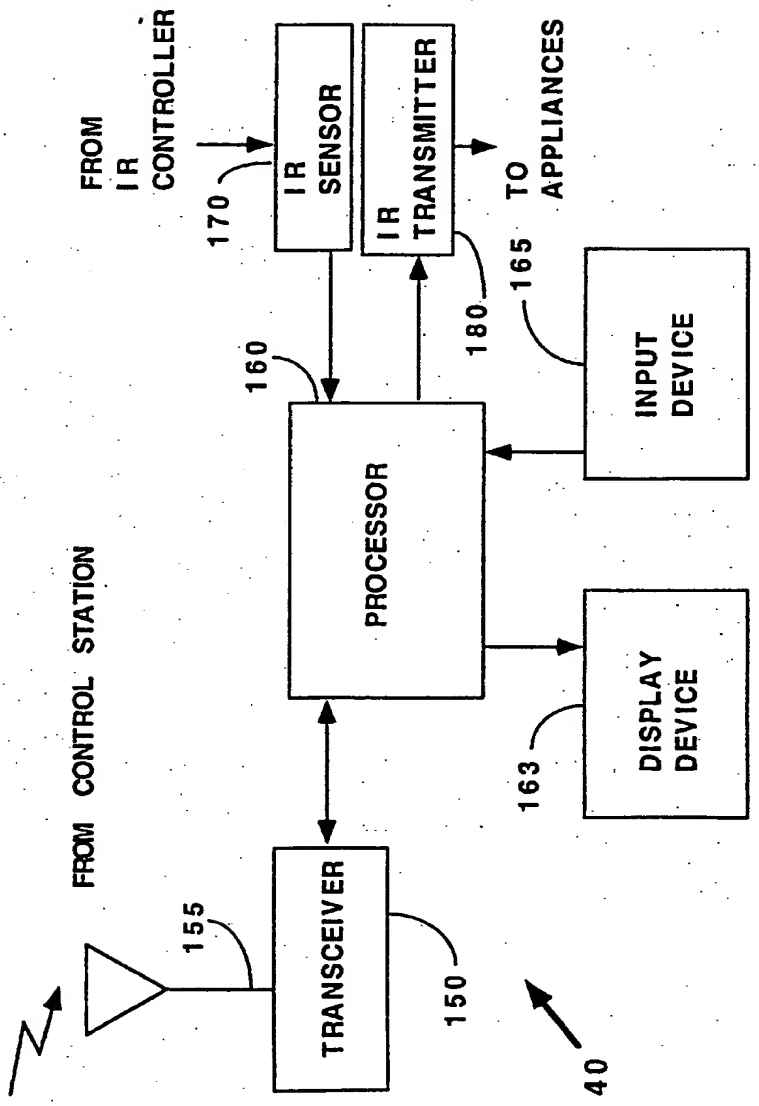

FROM CONTROL STATION
FROM IR CONTROLLER
TO APPLIANCES
IR SENSOR
IR TRANSMITTER
TRANSCEIVER
PROCESSOR
INPUT DEVICE
DISPLAY DEVICE
170
165
180
160
155
150
163
40

FIG. 4

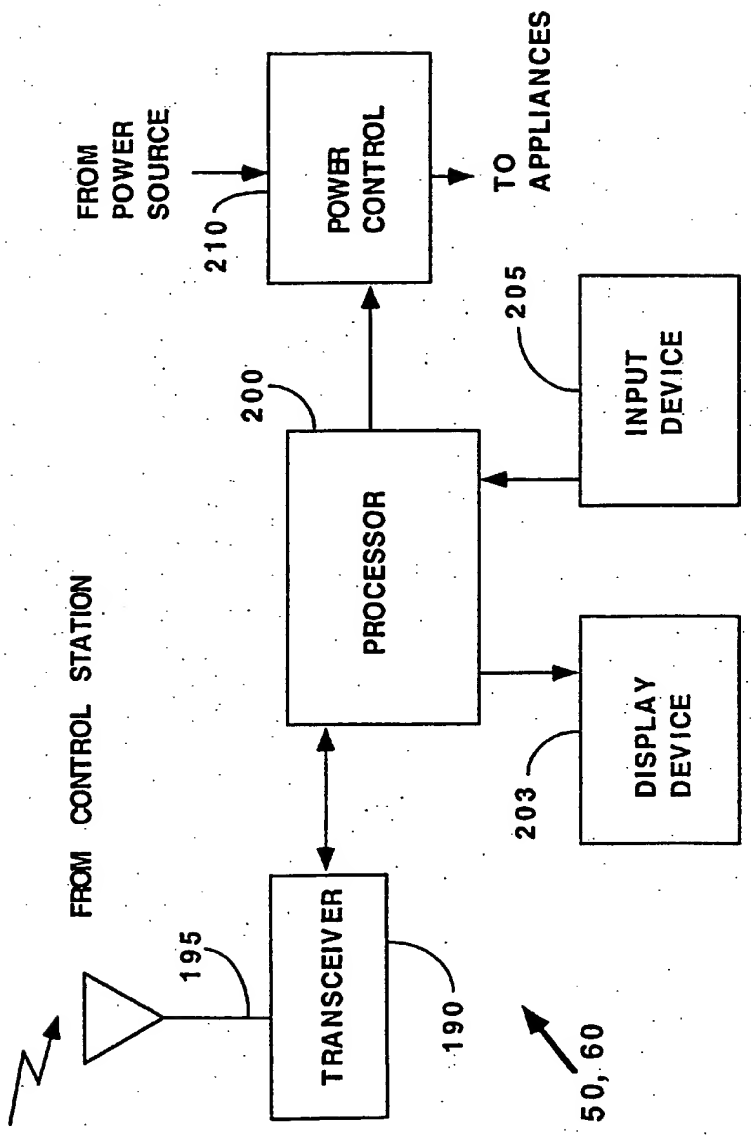

FROM POWER SOURCE
210
POWER CONTROL
TO APPLIANCES
205
INPUT DEVICE
200
PROCESSOR
DISPLAY DEVICE
203
FROM CONTROL STATION
195
TRANSCEIVER
190
50, 60

FIG. 5

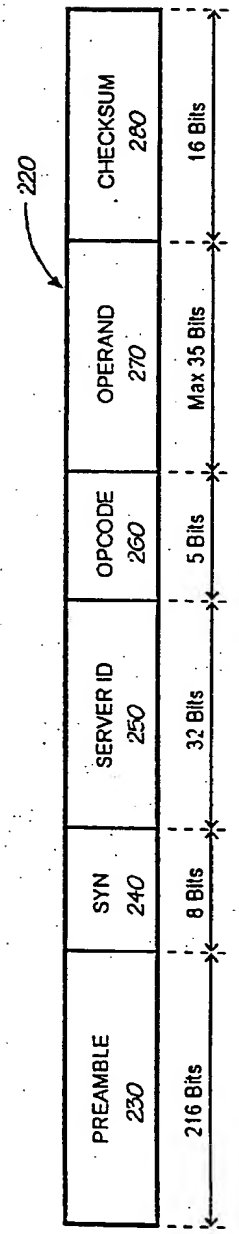

220
PREAMBLE 230
SYN 240
SERVER ID 250
OPCODE 260
OPERAND 270
CHECKSUM 280
216 Bits
8 Bits
32 Bits
5 Bits
Max 35 Bits
16 Bits

FIG. 6A

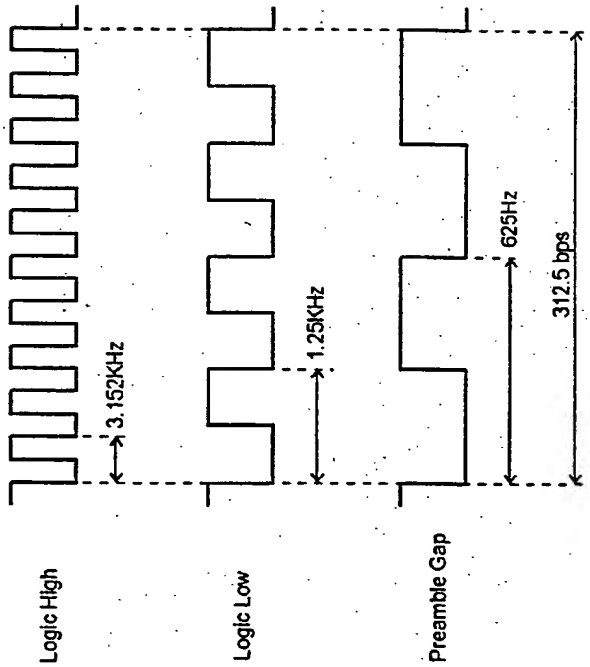

Logic High
3.152KHz
Logic Low
1.25KHz
Preamble Gap
625Hz
312.5 bps

FIG. 6B

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/SG 96/00003

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: G08C 17/02, 19/16, 23/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC G08C 17/02, 19/16, 23/04, H02J 13/00, 23/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
INSPEC-HOME, HOUSE, and AUTOMATION, AUTOMATIC.
JAPIO-RESIDEN: HOME, HOUSE, and AUTOMATION, AUTOMATIC.
DERWENT-RESIDEN: HOME, HOUSE, and AUTOMATION, AUTOMATIC.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	IEEE, Transactions on Consumer Electronics, Vol. 37, No. 2, May 1991, "The Consumer Electronics Bus Infrared System" (J. Hoffmann), pp 122-128.	1, 4-13, 16-22. 2, 3, 14, 15.
Y	IEEE, Transactions on Consumer Electronics, Vol. 37, No. 2, May 1991, "The EIA Consumer Electronics Bus Twisted Pair Network" (Grayson Evans), pp 101-107.	2, 3, 14, 15.
Y	IEEE, Transactions on Consumer Electronics, Vol. 36, No. 4, November 1990, "A Multi-function ISDN Home Communication System" (TZUNG-PAP LIN) pp 892-896.	2, 3, 14, 15.

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
11 July 1996

Date of mailing of the international search report
24 JUL 1996

Name and mailing address of the ISA/AU
AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION
PO BOX 200
WODEN ACT 2606
AUSTRALIA Facsimile No.: (06) 285 3929

Authorized officer
ROBERT BARTRAM
Telephone No.: (06) 283 2215

Form PCT/ISA/210 (second sheet) (July 1992) copkaj

PCT/INTERNATIONAL SEARCH REPORT

International Application No.
PCT/SG 96/00003

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PA	WO 95/35534 A (MULTI-MEDIA TELWARE INDUSTRIES LTD) 28 December 1995, G06F 3/023, H03J 1/00.	ALL
PA	WO 95/33328 A (EDSTRÖM KOMPONENT AB) 7 December 1995, H04M 11/00, G08C 17/02.	ALL
PA	GB 2286277 A (LE GROUPE VIDEOTRONLTEE) 9 August 1995, G08C 19/28, 17/02, 23/04.	ALL
A	WO 95/02231 A (MOE-NILSSEN) 19 January 1995, G08C 23/04, H05B 37/02.	ALL
A	GB 2259172 A (CHIN SING CHOY) 3 March 1993, G08C 23/00, 17/00.	ALL
A	EP 392872 A (MOLEX INCORPORATED) 17 October 1990, G08C 17/00, G08C 19/28.	ALL

Form PCT/ISA/210 (continuation of second sheet) (July 1992) copkaj

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/SG 96/00003

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	9535534	AU	28896/95	CA	2141497	EP	714528
		FR	2721730				
WO	9533328	AU	26863/95	SE	9401874		
GB	2286277	BE	1008741	CA	2140968	DE	19503761
		FR	2716027	IL	112301	IT	95500158
		NL	9500169	PT	101648		
WO	9502231	AU	72401/94	WO	9502231	NO	940510
GB	2259172	GB	9118751				
EP	392872	JP	2005896	US	5128667	AU	30153/89
		EP	330374				

END OF ANNEX

Form PCT/ISA/210 (patent family annex) (July 1992) copkaj